Advanced Software Engineering: Analysis and Evaluation

COMPSCI 621

UMass Amherst, Spring 2018

621 staff

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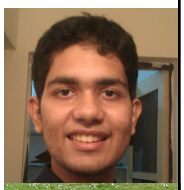
Teaching assistants



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Today's plan

- Why is software engineering important?
- About 621: how to succeed

What is software engineering?

- The process of developing software systems
- From eliciting requirements to producing a software system that meets those requirements
- May involve (among other activities)
  - eliciting and formalizing requirements
  - designing the system architecture
  - developing prototypes
  - testing
  - implementation
  - validation
  - verification
  - maintenance

What is analysis?

- This semester, we will focus on analysis:
  Identifying program properties to verify and validate the system.

The goal of analysis is to improve system correctness, quality, safety, and reliability by *analyzing* system source code and executions

How can we analyze software to improve it?

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- static analysis looks at the source code to prove properties about the software
- dynamic analysis looks at the executions to infer properties about the software
- testing examines executions for correctness

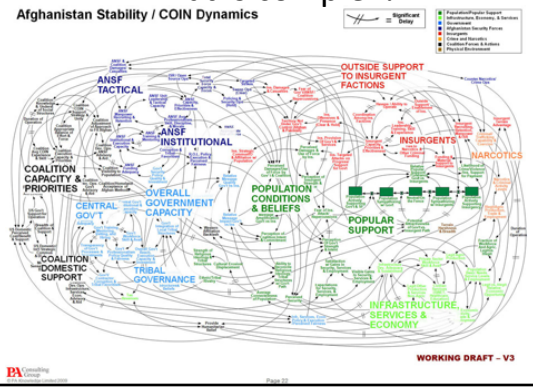
Why bother improving software?

Why bother improving software?

- Software is important: It runs our lives!
  - medical devices
  - cars, airplanes, factories
  - try living a day without software
- Software is complex, which leads to poor quality systems (e.g., bugs).

How complex is software?

What is complex?



How complex is software?

- Measures of complexity:
  - lines of code
  - number of classes
  - number of modules
  - module interconnections and dependencies
  - time to understand
  - # of authors
  - … many more

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Windows Server 2003: 50 MSLoC
Debian 5.0: 324 MSLoC

How big is 324 MSLoC?

- 50 lines/page ⇒ 6.5M pages
- 1K pages/ream ⇒ 6.5K reams
- 2 inches/ream ⇒ 13K inches
- 13K inches ≈ four times the height of this building

- 5 words/LoC @ 50 wpm ⇒ 32M min ≈ 61 years

And we don't just want random words, we want compiling code!

Managing software development

- Requirements
- Design
- Implementation
- Testing
- Maintenance

Ad-hoc development

- Creating software without any formal guidelines or process

- Advantage: easy to learn and use!
- Disadvantages?

Ad-hoc development disadvantages

- Some important actions (testing, design) may go ignored
- Unclear when to start or stop each task
- Scales poorly to multiple people
- Hard to review or evaluate one's work

The later a problem is found in software, the more costly it is to fix.

Why is software engineering important?

- Organizes the work effort
- Improves software quality
- Improves development efficiency
- and many more reasons

Today's plan

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➢About 621: how to succeed

The bigger picture

- CMPSCI 320: Introduction to software engineering: How to build a software system
- CMPSCI 520: Theory and Practice of Software Engineering
- CMPSCI 620: Advanced software engineering: Process
- CMPSCI 621: Advanced software engineering: Analysis and evaluation

621

- Focus on state-of-the-art techniques for program analysis
- State-of-the-art means exploring research
- Students will learn the latest techniques in improving software quality
- Students will advance the state-of-the-art by developing their own techniques!

621 website

http://cs.umass.edu/~brun/class/CS621

- Schedule, all logistics information, assignments, etc.
- Assignment submission and grades will be done via Moodle: http://moodle.umass.edu

The Work

Assignment	Grade
Midterm	25%
Homework	32%
Paper summary and presentation	15%
Participation	3%
Project	25%

Check the website frequently

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Next time

- We will discuss the six main topics covered by this class.
- We will identify possible open problems for research projects.